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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)
	10/807,187	MITSUI, TADASHI
	Examiner	Art Unit
	David P. Rashid	2624

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☐ Responsive to communication(s) filed on _____.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) 1-20 is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) 1-20 is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

All of the examiner's suggestions presented herein below have been assumed for examination purposes, unless otherwise noted.

Amendments

1. This office action is responsive to the claim and specification amendment received on 7/26/2007. Claims **1 – 20** remain pending.

Drawings

2. The replacement drawings were received on 7/26/2007 and are acceptable. In response to applicant's drawing amendments and remarks, the previous drawing objections are withdrawn.

Specification

3. In response to applicant's specification amendments and remarks received on 7/26/2007, the previous specification objections are withdrawn.

Claim Objections

4. In response to applicant's claim objections amendments and remarks received on 7/26/2007, the previous claim objections are withdrawn.

Claim Rejections - 35 USC § 103

5. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

6. **Claims 1, 2, 4, 5, 11, 12, 14, 15, 17,** and **19** are rejected under 35 U.S.C. 103(a) as being unpatentable over the combination between Takane et al. (US 6,538,249) and Gleason et al. (US 6,456,899 B1).

Regarding **claim 1**, while Takane discloses a pattern measuring apparatus ("[First embodiment] FIG. 3 is a diagram used to describe focus deviations which are a problem to be solved by the present invention.", column 5, line 58) comprising:

a storage device which stores a plurality of pattern images of a pattern to be measured and edge reference data which is used as reference to detect the edge of the pattern within the pattern images ("The digital signal S2 is fed to an image processing processor 110 which performs image processing such as differential processing of an image and extraction of characteristic quantities, and sends the results to a control computer 111.", column 5, line 4. It is inherent that since the disclosed invention is performed on a computer as in the reference given, the computer must contain some form of memory to store all images being acquired and/or used by the disclosed invention. As disclosed in FIG. 11, the plurality of pattern images is image set 1101 and the edge reference data is image set 1102. It must be noted that the images contain patterns as cited: "A charged particle beam apparatus such as a scanning electron microscope is suitable for measuring or observing patterns formed on a semiconductor wafer, which has been

becoming finer.", column 1, line 12.) and is configured of a plurality of pixels that are disposed so as to have an intensity gradient ("The figure illustrates an example in which pixel values from a Sobel filter are set as in-focus evaluation references. Like image differential, the Sobel filter is used to extract edge information of an image, and when a pixel value processed by a Sobel filter is large, this means that changes in pixel values around the pixel are large.", column 6, line 61. It is well known to one of ordinary skill in the art that a Sobel filter is a discrete differentiation operator, computing an approximation of the gradient of the image intensity function.), the pattern images being obtained by an external imaging device at different focal distances ("Numeral 1101 indicates a plurality of images captured by changing a focus, and 1102 indicates images obtained by processing each image 1101 by use of a Sobel filter.", column 7, line 1);

a calculator which scans the pattern image with said edge reference data, detects edge points of the pattern (The Sobel filter creating image set 1102 as mentioned above.), and also calculates a characteristic quantity that expresses a correlation between said edge reference data and the detected edge points of the pattern ("Pixels Sg1 through Sg5 at same coordinates in the plurality of images 1102 registered in the frame memories are compared, and of those pixels, a pixel of the largest value is extracted. Supposing that the pixel of the largest value is Sg2, a pixel value g2 of the original image of the pixel Sg2 is projected to a pixel at same coordinates in the composite image. A composite image 1103 is acquired by repeating this process for all coordinates of the image to select pixels of largest values, and arranging them to form a two-dimensional image.", column 7, line 6. The characteristic quantity is the equation given in FIG. 11, max(Sg1, Sg2, Sg3, Sg4, Sg5) = Sgx where Sqx is any one of the Sobel filter images. This

quantity expresses a correlation between the edge reference data 1102 and the detected edge points of the pattern image 1101, since they are equal.);

a determinator which determines an in-focus state that expresses the degree to which the focal position at which each pattern image is obtained conforms to a desired pattern edge, based on the calculated characteristic quantity (The determinator is the full conditional operator given in the equation from FIG. 11. For example,

if max(Sg1, Sg2, Sg3, Sg4, Sg5) = Sg2,

then g2 of original image is projected to the pixel of the composite image

and is properly based upon the calculated characteristic quantity. Sg2 in this case has been determined to be the in-focus state of that particular pixel when creating the composite image. "Then, in-focus portions can be extracted from each image so as to produce a composite image, which is a two-dimensional image focusing on all surfaces of the sample. These two images are registered in, for example, two frame memories.", column 6, line 11.)

an image selector which selects the pattern image that conforms to measurement of the pattern from a plurality of the pattern images, in accordance with the determination result of said in-focus state determinator (FIG. 11 discloses the image selector with the example given where a pixel of image g2 is projected to the pixel of the composite image as defined by a vertical arrow. In essence, the determinator and image selector perform the same function as disclosed by Takane.), Takane does not teach a measurer which processes the selected pattern image to measure the pattern.

Gleason discloses a context-based automated defect classification system using multiple morphological masks ("It is an object of the invention to provide an automated semiconductor

wafer defect classification system that classifies defects based on a combination of their location with respect to process layers of the semiconductor wafer and the defect characteristics.", column 1, line 45) that teaches a measurer which processes the selected pattern image to measure the pattern ("The next component of the defect feature-based classifier 36 is the defect feature selector 32. It takes as its input the list of defect features 34, and pares that list down into a selected set of features 35. The defect feature selector 32 pares down the feature list 34 by accessing the knowledge base 23 and retrieving a list of existing discriminatory features for the current semiconductor device under inspection. This list of discriminatory defect features 34 is then passed on to the defect classifier 33.", column 5, line 1.).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to incorporate into the pattern measuring apparatus of Takane the measurer of Gleason to process the selected pattern image of Takane to measure the pattern as taught by Gleason so that "...the usefulness of each individual feature for a given situation is determined..."., Gleason, column 9, line 6.

Regarding **claim 2**, Takane discloses wherein said external imaging device includes an optical system which is capable of adjusting focal position thereof within a range defined by an integer multiple of a predetermined step width from a predetermined initial value ("FIG. 2 is a graph showing changes in a focus evaluation value as electron lens conditions are changed;", column 2, line 66. m As shown in FIG. 2, the changes in focus (exciting current of electron lens) are shown from 0 to 20, which are integer multiples of a predetermined step width (unit 1) from a predetermined initial value (unit 0). The electron microscope disclosed can adjust its focal position thereof within this range.); and the plurality of the pattern images are pattern images that

have been obtained by imaging at each of focal positions calculated by adding integral multiples of the step width to said initial value (Each focus evaluation taken from FIG. 2 is from an integer multiple of the unit 1, and these are applied to the current embodiment as follows: "FIG. 11 is a schematic diagram showing a composing process according to the present invention. The figure illustrates an example in which pixel values from a Sobel filter are set as in-focus evaluation references.", column 6, line 60.).

Regarding **claim 4**, while Takane discloses wherein the image selector selects a plurality of pattern images in accordance with the determination results of the in-focus state determinator (It has been assumed for examination purposes that a "plurality" is the largest share of something, which may or may not be considered a majority. The equation as disclosed in FIG. 11 requires the operation of "maximum" from a set of pixels in separate images. It is well known to one of ordinary skill in the art that the maximum can only be one pixel, and the definition of majority selected holds. In fact, the definition of majority holds again when there exists more than one pixel with the maximum value - in essence all of these pixels will be selected (the majority) since their value is maximum.); and

said pattern measuring apparatus further comprises an image processor which performs alignment processing between the selected plurality of pattern images and performs image processing to combine the selected pattern images (refer to references cited in claim 1), Takane does not teach the measurer measures the pattern on the basis of the combined pattern images.

Gleason discloses a context-based automated defect classification system using multiple morphological masks ("It is an object of the invention to provide an automated semiconductor wafer defect classification system that classifies defects based on a combination of their location

with respect to process layers of the semiconductor wafer and the defect characteristics.", column 1, line 45) that teaches a measurer measuring the pattern on the basis the pattern images ("The next component of the defect feature-based classifier 36 is the defect feature selector 32. It takes as its input the list of defect features 34, and pares that list down into a selected set of features 35. The defect feature selector 32 pares down the feature list 34 by accessing the knowledge base 23 and retrieving a list of existing discriminatory features for the current semiconductor device under inspection. This list of discriminatory defect features 34 is then passed on to the defect classifier 33.", column 5, line 1.).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to incorporate into the pattern measuring apparatus of Takane the measurer measuring the pattern on the basis of the pattern images (of which is an image of the combined images as disclosed by Takane) as taught by Gleason so that "...the usefulness of each individual feature for a given situation is determined...", Gleason, column 9, line 6.

Regarding **claim 5**, while the combination between Takane and Gleason disclose the pattern measuring apparatus according to claim 1, the combination does not teach wherein only edge points of the pattern which have been detected from previously processed pattern images and which are within a predetermined range are scanned with said edge reference data.

Gleason discloses a context-based automated defect classification system using multiple morphological masks ("It is an object of the invention to provide an automated semiconductor wafer defect classification system that classifies defects based on a combination of their location with respect to process layers of the semiconductor wafer and the defect characteristics.", column 1, line 45) that teaches wherein only edge points of the pattern which have been detected

from previously processed pattern images ("Next, in the layer feature selector 17, columns of features from the table 19 are selected using information stored in the knowledge database 23. The stored information is information that had been previously generated in an off-line training and analysis procedure. The layer feature selector 17 then performs statistical analysis on the training features, and each feature is ranked based on its ability to discriminate between possible classes. The information in the database 23 is considered a recipe generated for a specific set of operating conditions, e.g., wafer size, processing step, geometry. The new list of features 20 that is generated from this selection is a subset, or possibly all, of the original features 19.", column 6, line 25.) and which are within a predetermined range ("FIG. 3 shows the background layer segmenter 13 in more detail. It includes a difference-of-Gaussians edge detector 47 which carries out edge extraction using a difference-of-Gaussians method; an excess colorspace converter 48 which transforms the intensity values of the reference image; and a continuous region labeler 49 which segments the regions based on edge boundaries, image intensity measurements, adaptive thresholding, and finally a morphological closing process that results in the segmented reference image 14.", column , line wherein the edge detector uses a threshold (predetermined range) to create layers that are then considered for the knowledge database 23 to be compared with later if accepted into the knowledge database 23.) are scanned with said edge reference data (Scanning for the data already in the knowledge database 23 and the image data currently being compared is considered scanning "with" each other.).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to incorporate into the pattern measuring apparatus of Takene wherein only edge points of the pattern which have been detected from previously processed pattern images so for

creating and which are within a predetermined range are scanned with the edge reference data as taught by Gleason to create "...a recipe generated for a specific set of operating conditions...", Gleason, column 6, line 33.

Regarding **claim 11**, while Takane discloses a method of measuring a method of measuring a pattern to be measured from a plurality of pattern images obtained by capturing the pattern by an imaging device at different focal positions (refer to references cited in claim 1), said pattern measuring method comprising:

detecting edge points of a pattern to be measured by scanning the pattern with edge reference data which is used as reference to detect the edges of the pattern within pattern images (refer to references cited in claim 1) and which is configured of a plurality of pixels that are disposed so as to have an intensity gradient (refer to references cited in claim 1), and also calculating a characteristic quantity which expresses a correlation between said edge reference data and the pattern, the edge points of which have been detected (refer to references cited in claim 1);

determining an in-focus state that expresses the degree to which the focal position at which each obtained pattern image is obtained conforms to a desired pattern edge, based on said characteristic quantity that has been calculated (refer to references cited in claim 1); and

selecting the pattern image which conforms to measurement of the pattern from a plurality of the pattern images, in accordance with the result of determining said in-focus state (refer to references cited in claim 1), Takane does not teach processing the selected pattern image to measure the pattern.

Gleason discloses a context-based automated defect classification system using multiple morphological masks ("It is an object of the invention to provide an automated semiconductor wafer defect classification system that classifies defects based on a combination of their location with respect to process layers of the semiconductor wafer and the defect characteristics.", column 1, line 45) that teaches processing the selected pattern image to measure the pattern ("The next component of the defect feature-based classifier 36 is the defect feature selector 32. It takes as its input the list of defect features 34, and pares that list down into a selected set of features 35. The defect feature selector 32 pares down the feature list 34 by accessing the knowledge base 23 and retrieving a list of existing discriminatory features for the current semiconductor device under inspection. This list of discriminatory defect features 34 is then passed on to the defect classifier 33.", column 5, line 1.).

It would have been obvious to one of ordinary skill in the art to processing the selected pattern image to measure the pattern (of which is an image of the combined images as disclosed by Takane) as taught by Gleason so that "…the usefulness of each individual feature for a given situation is determined…"., Gleason, column 9, line 6.

Regarding **claim 12**, claim 2 recites identical features as in claim 12. Thus, arguments equivalent to those presented above for claim 2 is equally applicable to claim 12.

Regarding **claim 14**, claim 4 recites identical features as in claim 14. Thus, arguments equivalent to those presented above for claim 4 is equally applicable to claim 14.

Regarding **claim 15**, claim 5 recites identical features as in claim 15. Thus, arguments equivalent to those presented above for claim 5 is equally applicable to claim 15.

Regarding **claim 17**, Takane discloses wherein the characteristic quantity is calculated by using a plurality of sets of the edge reference data (As described above, the characteristic quantity is the maximum equation in FIG. 11 which involves a plurality of sets of the edge reference data (Sobel filter images). A pixel from each edge reference data is inputted into the characteristic quantity.).

Regarding **claim 19**, claim 11 recites identical features as in the method of manufacturing of claim 19. Thus, arguments equivalent to those presented above for claim 11 is equally applicable to claim 19.

13. **Claims 3** and **13** are rejected under 35 U.S.C. 103(a) as being unpatentable over the combination between Takane et al. (US 6,538,249) "first embodiment" and Gleason et al. (US 6,456,899 B1), in further view of Takane et al. (US 6,538,249) "eighth embodiment".

Regarding **claim 3**, the combination between Takane "first embodiment" and Gleason disclose the pattern measuring apparatus according to claim 1, while Takane "first embodiment" further discloses

wherein said image selector selects a plurality of pattern images in accordance with the determination results of said in-focus state determinator (It has been assumed for examination purposes that a "plurality" is the largest share of something, which may or may not be considered a majority. The equation as disclosed in FIG. 11 requires the operation of "maximum" from a set of pixels in separate images. It is well known to one of ordinary skill in the art that the maximum can only be one pixel, and the definition of majority selected holds. In fact, the definition of majority holds again when there exists more than one pixel with the maximum

value - in essence all of these pixels will be selected (the majority) since their value is maximum.);

said pattern measuring apparatus further comprises an image processor which performs superimposing in a single coordinate system the edge points of the pattern within the pattern images (refer to references cited in claim 1); and

said measurer measures the pattern on the basis of position coordinates of pattern edge points that have been superposed in said single coordinate system (refer to references cited in claim 1), however Takane "first embodiment" does not teach the pattern measuring apparatus further comprising an image processor which performs alignment processing among said selected plurality of pattern images.

Takane "eighth embodiment" teaches a pattern measuring apparatus further comprising an image processor which performs alignment processing among pattern images ("An optical microscope image acquired by magnifying the alignment pattern a few hundreds times is compared with an alignment pattern reference image registered in the memory unit 3015, and correct the stage position coordinates to exactly align the visual field of the optical microscope image with that of the reference image.", column 16, line 50).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to teach an image processor which performs alignment processing among pattern images as taught by Takane "eighth embodiment" "...to correct the position coordinate system on the X-Y stage and the pattern position coordinate system in the wafer.", Takane "eighth embodiment", column 16, line 48.

Regarding **claim 13**, claim 3 recites identical features as in claim 13. Thus, arguments equivalent to those presented above for claim 3 is equally applicable to claim 13.

7. **Claims 6** and **16** are rejected under 35 U.S.C. 103(a) as being unpatentable over the combination between Takane et al. (US 6,538,249) "first embodiment" and Gleason et al. (US 6,456,899 B1), in further view of Takane et al. (US 6,538,249) "fourth embodiment".

Regarding **claim 6**, the combination between Takane "first embodiment" and Gleason disclose the pattern measuring apparatus according to claim 1, and while the Takane "first embodiment" further discloses

said calculator classifies said edge points that have been detected into edge point groups for each of said edge lines, and calculates a characteristic quantity for each of said edge point groups that have been classified (The groups (referred to as "sections" by Takane) are those shown in FIG. 4 of the first embodiment of the invention (showing two in-focus groups). Refer to the references cited in claim 1. The calculator classifies every pixel of the image with the maximum function, thus the calculator naturally classifies edge points that have been detected into edge point groups for each of the edge lines, and further calculates a characteristic quantity for each of the edge point groups that have been classified.); and

said determinator determines the in-focus state of the pattern image for each of said edge point groups that have been classified (Refer to the references cited in claim 1. The determinator determines every pixel of the image with the full conditional maximum function, thus the determinator naturally determines the in-focus state of the pattern image for each of said edge point groups that have been classified.), the combination does not teach wherein the pattern has a

plurality of edge lines (Takane "first embodiment", FIG. 4 discloses a "hole" of the "first embodiment" which only has one edge line – the circle itself).

Takane "fourth embodiment" teaches a pattern measuring apparatus further comprising wherein the pattern has a plurality of edge lines (" FIG. 9 shows indication examples for displaying composite images on a real time basis according to the present invention.", column 9, line 60. The pattern shown in FIG. 9 are holes, each with two edge lines and hence a plurality of edge lines.)

It would have been obvious to one of ordinary skill in the art at the time the invention was made to teach the pattern having a plurality of edge lines as taught by Takane "fourth embodiment", to differentiate a plurality of sections of the pattern to be further processed by the disclosed invention.

Regarding **claim 16**, claim 6 recites identical features as in claim 16. Thus, arguments equivalent to those presented above for claim 6 is equally applicable to claim 16.

15. **Claims 7, 8, 10, 18,** and **20** are rejected under 35 U.S.C. 103(a) as being unpatentable over the combination between Takane et al. (US 6,538,249) "first embodiment" and Gleason et al. (US 6,456,899 B1), in further view of Takane et al. (US 6,538,249) "eleventh embodiment".

Regarding **claim 7**, while Takane "first embodiment" discloses a pattern measuring apparatus which is connectable to an external imaging device and which inspects a pattern to be measured on the basis of a pattern image supplied from the external imaging device ("A signal S1 from the detector 103 is input to an AD converter 107, which converts the signal into a digital signal S2. ", column 5, line 1 in combination with FIG. 1.), the external imaging device capturing

an image of the pattern to be measured with an optical system (The optical system is disclosed in FIG. 1: "In FIG. 1, reference numerals 101 and 102 denote a sample stage and a sample to be imaged on the sample stage, respectively; 104 denotes a cathode; 105 represents a scanning coil; 106 represents an electron lens; 108 denotes a scanning coil control circuit; and 109 denotes a lens control circuit.", column 4, line 47), a focal position of the optical system being adjustable with respect to the pattern by an integer multiple of a predetermined step width from a predetermined initial value (refer to references cited in claim 2), said pattern measuring apparatus comprising:

a storage device which stores edge reference data which is used as reference to detect the edge of the pattern within pattern images and which is configured of a plurality of pixels that are disposed so as to have an intensity gradient (refer to references cited in claim 1);

a characteristic quantity calculator which scans each pattern image with said edge reference data, detects edge points of the pattern to be measured, and also calculates a characteristic quantity that expresses a correlation between the detected pattern and said edge reference data (refer to references cited in claim 1); and

a determinator which determines an in-focus state that expresses the degree to which the focal position at which each pattern image is obtained conforms to a desired pattern edge, based on said characteristic quantity that has been calculated (refer to references cited in claim 1), Takane "first embodiment" does not teach

(i) a focal-position controller which generates and outputs control signals to change the focal position of the optical system of the external imaging device if said

determinator has determined that the focal position at the time of capture of the pattern image does not conform to said desired pattern edge and

(ii) a measurer which operates to process the pattern image to measure the pattern if said determinator has determined that the focal position at the time of capture of the pattern image conforms to said desired pattern edge.

Gleason discloses a context-based automated defect classification system using multiple morphological masks ("It is an object of the invention to provide an automated semiconductor wafer defect classification system that classifies defects based on a combination of their location with respect to process layers of the semiconductor wafer and the defect characteristics.", column 1, line 45) that teaches a measurer which operates to process the pattern image to measure the pattern if the determinator has determined that the focal position at the time of capture of the pattern image conforms to the desired pattern edge ("The next component of the defect feature-based classifier 36 is the defect feature selector 32. It takes as its input the list of defect features 34, and pares that list down into a selected set of features 35. The defect feature selector 32 pares down the feature list 34 by accessing the knowledge base 23 and retrieving a list of existing discriminatory features for the current semiconductor device under inspection. This list of discriminatory defect features 34 is then passed on to the defect classifier 33.", column 5, line 1. The determinator as disclosed by Takane "first embodiment" will always determine that each pattern image obtained conforms to a desired pattern edge, based on said characteristic quantity that has been calculated since a maximum pixel from one of the Sobel filter images will always be calculated every time.).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to processing the selected pattern image to measure the pattern (of which is an image of the combined images as disclosed by Takane "first embodiment") as taught by Gleason so that "…the usefulness of each individual feature for a given situation is determined…"., Gleason, column 9, line 6.

The combination between Takane "first embodiment" and Gleason disclose the pattern measuring apparatus described above, however the combination does not teach a focal-position controller which generates and outputs control signals to change the focal position of the optical system of the external imaging device if said determinator has determined that the focal position at the time of capture of the pattern image does not conform to said desired pattern edge.

Takane "eleventh embodiment" teaches a focal-position controller which generates and outputs control signals to change the focal position of the optical system of the external imaging device if said determinator has determined that the focal position at the time of capture of the pattern image does not conform to the desired pattern edge ("A maximum value storage means 4410 currently stores a maximum signal change amount value 4411 calculated up to the last image. A maximum value calculating means 4420 compares the maximum signal change amount value 4411 calculated up to the last image against a signal change amount 4321 of the current image, and selects the larger one as a maximum signal change amount value 4342 for up to the current image to update the maximum value stored in the maximum value storage means 4410 with the selected value. A subtracting means 4430, on the other hand, calculates the difference between the maximum signal change amount value 4411 calculated up to the last image and the signal change amount 4321 of the current image, and a binarizing means 4440 determines

whether the difference is larger than zero. That is, when the signal change amount 4321 is denoted as f and the maximum signal change amount value 4411 calculated up to the last image is denoted as fmax and composition information 4341 is represented as g,

if $f > fmax$, $g=1$

if $f < fmax$, $g=0$

Therefore, when the signal change amount 4321 is larger than the maximum signal change amount value 4411 calculated up to the last image, g=1. That is, when a pixel of the current image should be selected as that for a composite image, its composition information g is set to 1.", column 20, line 60.

Fmax relates to that disclosed in FIG. 2 which is the maximum value of the focus evaluation. "Here, differential values between pixels or the like are used as focus evaluation values.", column 5, line 26 – therefore edge pixels are being compared to determine Fmax and it is well known to one of ordinary skill in the art that differential values between pixels involves intensity gradient and edge detection using a Sobel filter to generate the Sobel filter images.).

It would have been obvious to one of ordinary skill in the art to disclose a focal-position controller which generates and outputs control signals to change the focal position of the optical system of the external imaging device if said determinator has determined that the focal position at the time of capture of the pattern image does not conform to said desired pattern edge as taught by Tanake "eleventh embodiment" for "…focus determination…", Tanake "eleventh embodiment", column 20, line 60.

Regarding **claim 8**, claim 5 Takane "first embodiment" recites identical features as in claim 8. Thus, arguments equivalent to those presented above for claim 5 Takane "first embodiment" is equally applicable to claim 8.

Regarding **claim 10**, Takane "first embodiment" discloses wherein the characteristic quantity is calculated by using a plurality of sets of the edge reference data (As described above, the characteristic quantity is the maximum equation in FIG. 11 which involves a plurality of sets of the edge reference data (Sobel filter images). A pixel from each edge reference data is inputted into the characteristic quantity.).

Regarding **claim 18**, while Takane "first embodiment" discloses a method of measuring a pattern based on an image of a pattern to be measured which is obtained by an imaging device which captures the pattern to be measured ("A signal S1 from the detector 103 is input to an AD converter 107, which converts the signal into a digital signal S2. ", column 5, line 1 in combination with FIG. 1.) and includes an optical system (The optical system is disclosed in FIG. 1: "In FIG. 1, reference numerals 101 and 102 denote a sample stage and a sample to be imaged on the sample stage, respectively; 104 denotes a cathode; 105 represents a scanning coil; 106 represents an electron lens; 108 denotes a scanning coil control circuit; and 109 denotes a lens control circuit.", column 4, line 47) thereof being adjustable with respect to the pattern by an integer multiple of a predetermined step width from an initial value (refer to references cited in claim 2), said method comprising:

detecting edge points of a pattern to be measured by scanning an image of the pattern with edge reference data which is used as reference to detect the edge points of the pattern (refer to references cited in claim 1) and which is configured of a plurality of pixels that are disposed

so as to have an intensity gradient (refer to references cited in claim 1), and calculating a characteristic quantity which expresses a correlation between said edge reference data and the pattern, the edge of which has been detected (refer to references cited in claim 1); and

determining an in-focus state that expresses the degree to which the focal position at which each pattern image is obtained conforms to a desired pattern edge, based on said characteristic quantity that has been calculated (refer to references cited in claim 1), Takane "first embodiment" does not teach

(i) obtaining a new image of the pattern at different focal positions until it is determined that it conforms to said desired pattern edge by varying the focal position of the optical system if it has been determined that the focal position at the time of capture of the pattern image does not conform to said desired pattern edge and

(ii) processing the image of the pattern to measure the pattern if it has been determined that the focal position at the time of capture of the pattern image conforms to said desired pattern edge.

Gleason discloses a context-based automated defect classification system using multiple morphological masks ("It is an object of the invention to provide an automated semiconductor wafer defect classification system that classifies defects based on a combination of their location with respect to process layers of the semiconductor wafer and the defect characteristics.", column 1, line 45) that processes the image of the pattern to measure the pattern if it has been determined that the focal position at the time of capture of the pattern image conforms to the desired pattern edge ("The next component of the defect feature-based classifier 36 is the defect

feature selector 32. It takes as its input the list of defect features 34, and pares that list down into a selected set of features 35. The defect feature selector 32 pares down the feature list 34 by accessing the knowledge base 23 and retrieving a list of existing discriminatory features for the current semiconductor device under inspection. This list of discriminatory defect features 34 is then passed on to the defect classifier 33.", column 5, line 1. The determinator as disclosed by Takane "first embodiment" will always determine that each pattern image obtained conforms to a desired pattern edge, based on said characteristic quantity that has been calculated since a maximum pixel from one of the Sobel filter images will always be calculated every time.).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to process the image of the pattern to measure the pattern if it has been determined that the focal position at the time of capture of the pattern image conforms to the desired pattern edge (of which is an image of the combined images as disclosed by Takane "first embodiment") as taught by Gleason so that "...the usefulness of each individual feature for a given situation is determined...", Gleason, column 9, line 6.

The combination between Takane "first embodiment" and Gleason disclose the method of measuring a pattern as described above, however the combination does not teach obtaining a new image of the pattern at different focal positions until it is determined that it conforms to the desired pattern edge by varying the focal position of the optical system if it has been determined that the focal position at the time of capture of the pattern image does not conform to the desired pattern edge.

Takane "eleventh embodiment" teaches a focal-position controller which obtains a new image of the pattern at different focal positions until it is determined that it conforms to the

desired pattern edge by varying the focal position of the optical system if it has been determined that the focal position at the time of capture of the pattern image does not conform to the desired pattern edge ("A maximum value storage means 4410 currently stores a maximum signal change amount value 4411 calculated up to the last image. A maximum value calculating means 4420 compares the maximum signal change amount value 4411 calculated up to the last image against a signal change amount 4321 of the current image, and selects the larger one as a maximum signal change amount value 4342 for up to the current image to update the maximum value stored in the maximum value storage means 4410 with the selected value. A subtracting means 4430, on the other hand, calculates the difference between the maximum signal change amount value 4411 calculated up to the last image and the signal change amount 4321 of the current image, and a binarizing means 4440 determines whether the difference is larger than zero. That is, when the signal change amount 4321 is denoted as f and the maximum signal change amount value 4411 calculated up to the last image is denoted as fmax and composition information 4341 is represented as g,

if f>fmax, g=1

if f<fmax, g=0

Therefore, when the signal change amount 4321 is larger than the maximum signal change amount value 4411 calculated up to the last image, g=1. That is, when a pixel of the current image should be selected as that for a composite image, its composition information g is set to 1.", column 20, line 60.

Fmax relates to that disclosed in FIG. 2 which is the maximum value of the focus evaluation. "Here, differential values between pixels or the like are used as focus evaluation

values.", column 5, line 26 – therefore edge pixels are being compared to determine Fmax and it is well known to one of ordinary skill in the art that differential values between pixels involves intensity gradient and edge detection using a Sobel filter to generate the Sobel filter images.).

It would have been obvious to one of ordinary skill in the art to disclose obtaining a new image of the pattern at different focal positions until it is determined that it conforms to the desired pattern edge by varying the focal position of the optical system if it has been determined that the focal position at the time of capture of the pattern image does not conform to the desired pattern edge as taught by Tanake "eleventh embodiment" for "…focus determination…", Tanake "eleventh embodiment", column 20, line 60.

Regarding **claim 20**, claim 18 recites identical features as in the method of manufacturing of claim 20. Thus, arguments equivalent to those presented above for claim 18 is equally applicable to claim 20.

8. **Claim 9** is rejected under 35 U.S.C. 103(a) as being unpatentable over the combination between Takane et al. (US 6,538,249) "first embodiment", Gleason et al. (US 6,456,899 B1), and Takane et al. (US 6,538,249) "eleventh embodiment" in further view of Takane et al. (US 6,538,249) "fourth embodiment".

Regarding **claim 9**, while the combination between Takane "first embodiment", Gleason, and Takene eleventh embodiment disclose the pattern measurement apparatus according to claim 7, and while the Takane "first embodiment" further discloses

said calculator classifies said edge points that have been detected into edge point groups for each of said edge lines, and calculates a characteristic quantity for each of said edge point

groups that have been classified (The groups (referred to as "sections" by Takane) are those shown in FIG. 4 of the first embodiment of the invention (showing two in-focus groups). Refer to the references cited in claim 1. The calculator classifies every pixel of the image with the maximum function, thus the calculator naturally classifies edge points that have been detected into edge point groups for each of the edge lines, and further calculates a characteristic quantity for each of the edge point groups that have been classified.); and

said determinator determines the in-focus state of the pattern image for each of said edge point groups that have been classified (Refer to the references cited in claim 1. The determinator determines every pixel of the image with the full conditional maximum function, thus the determinator naturally determines the in-focus state of the pattern image for each of said edge point groups that have been classified.), the combination does not teach wherein the pattern has a plurality of edge lines (Takane "first embodiment", FIG. 4 discloses a "hole" of the "first embodiment" which only has one edge line – the circle itself).

Takane "fourth embodiment" teaches a pattern measuring apparatus further comprising wherein the pattern has a plurality of edge lines (" FIG. 9 shows indication examples for displaying composite images on a real time basis according to the present invention.", column 9, line 60. The pattern shown in FIG. 9 are holes, each with two edge lines and hence a plurality of edge lines.)

It would have been obvious to one of ordinary skill in the art at the time the invention was made to teach the pattern having a plurality of edge lines as taught by Takane "fourth embodiment", to differentiate a plurality of sections of the pattern to be further processed by the disclosed invention.

Response to Arguments

9. Applicant's arguments filed 7/26/2007 with respect to **claims 1 – 20** have been respectfully and fully considered, but they are not found persuasive.

10. **Summary of Remarks** regarding **claims 1, 7, 11,** and **18 – 20:**

(i) Applicant argues Takane fails to or suggest a pattern measuring apparatus comprising, inter alia, a calculator which "detects", or a method comprising, inter alia, "detect[ing]" an "edge" of a "pattern" "by scanning an image of the pattern with edge reference data," as recited in amended claims 1, 7, 11, and 18 – 20 (@ *response page 20*).

A Sobel filter computes an approximation of the gradient of an image intensity function. But merely computing an intensity gradient, as performed by the Sobel filter in Takane, does not constitute "detect[inq]" an "edge" of a "pattern by scanning an image of the pattern with edge reference data," as required by claims 1, 7, 11, and 18 - 20. For example, Takane does not teach or suggest any processing of the intensity gradient in order to "detect" any particular "edge" of the sample represented by the image, as would be required by claims 1, 7, 11, and 18-20. In contrast, claims 1, 7, 11, and 18-20 recite that the "edge reference data" is used as a "reference" to "detect" the "edge." Thus, Takane fails to teach or suggest "detect[ing]" an "edge" of a "pattern" by scanning an image of the pattern with edge reference data," as recited in claims 1, 7, 11, and 18-20 (@ *response page 21*).

(ii) Gleason does not make up for the deficiencies of Takane because Gleason also fails to teach or suggest constitute "detect[inq]" an "edge" of a "pattern by scanning an image of the

pattern with edge reference data," as required by claims 1, 7, 11, and 18 – 20. The Examiner only relies on Gleason to allegedly teach other limitations of the claim.

(iii) Furthermore, the Examiner has not identified any apparent reason why one of ordinary skill would modify Takane and Gleason, either alone or in combination, to obtain "detect[inq]" an "edge" of a "pattern by scanning an image of the pattern with edge reference data," as required by claims 1, 7, 11, and 18 – 20.

11. **Examiner's Response** regarding **claims 1, 7, 11,** and **18 – 20:**

(i) In response to applicant's argument that the references fail to show certain features of applicant's invention, it is noted that the features upon which applicant relies (i.e., a method comprising, inter alia, "<u>detect[inq]</u>" an "<u>edge</u>" of a "<u>pattern by scanning an image of the pattern with edge reference data,</u>") are not recited in the rejected claim. Although the claims are interpreted in light of the specification, limitations from the specification are not read into the claims. See *In re Van Geuns*, 988 F.2d 1181, 26 USPQ2d 1057 (Fed. Cir. 1993).

However, the element in the claim pertinent to the applicant's argument above cites "a calculator which <u>scans the pattern image with said edge reference data</u>, <u>detects edge points of the pattern</u>, and also calculates a characteristic quantity..." directly implying that the calculator (the calculator responsible for the whole process of FIG. 11) is performing three **independent** functions:

(1) scanning (the mapping of pixels from 1101 to 1102 in FIG. 11 (e.g. pixel "g1" to "Sg1") in the Sobel filtration process) the pattern image (FIG. 11, element 1101) with said edge reference data (FIG. 11, element 1102);

(2) detecting edge points of the pattern (the calculator is detecting edge points of the pattern – which is doing so when Sobel filtering to create images 1102 from the pattern in images 1101 as Sobel is a edge detection algorithm); and

(3) calculates a characteristic quantity…(*not relevant to the issue*).

The applicant is arguing a stricter limitation from what is being disclosed in the claim by asserting that the detection of an edge of a pattern (step (2) above) is being only done by scanning an image of the pattern with edge reference data, placing a condition that step (2) is dependent on step (1) when in fact the claims are construed in such a way that the calculator (or method as a whole) can perform all steps (1), (2), and (3) independently.

For the reasons given above, Takane does in fact anticipate the calculator element (or equivalent thereof) of the independent claims.

(ii) Though Gleason fails to teach or suggest constitute "detect[inq]" an "edge" of a "pattern by scanning an image of the pattern with edge reference data," as required by claims 1, 7, 11, and 18 – 20, it has been shown in **Section (11)(i)** that Takane does in fact anticipate the calculator element (or equivalent thereof) of the independent claims.

(iii) It has been shown in **Section (11)(i)** that Takane does in fact anticipate the calculator element (or equivalent thereof) of the independent claims, and thus showing any apparent reason why one of ordinary skill would modify Takane and Gleason, either alone or in combination, to obtain "detect[inq]" an "edge" of a "pattern by scanning an image of the pattern with edge reference data," as required by claims 1, 7, 11, and 18 – 20 is not necessary as this stricter limitation is not recited in the claim.

12. **Summary of Remarks** regarding **claims 2 – 6, 8 – 10,** and **12 – 17:**

Applicant argues that since it would not have been obvious to one of ordinary skill to combine Takane and Gleason to obtain "detect[inq]" an "edge" of a "pattern by scanning an image of the pattern with edge reference data," as required by claims 1, 7, 11, and 18 – 20, these claims and claims 2 – 6, 8 – 10, and 12 – 17, which dependent from some of the independent claims, are allowable over Takane and Gleason.

13. **Examiner's Response** regarding **claims 2 – 6, 8 – 10,** and **12 – 17:**

It has been shown in **Section (11)(i)** that Takane does in fact anticipate the calculator element (or equivalent thereof) of the independent claims, and thus the prior art does in fact anticipate claims 1, 7, 11, and 18 – 20. The anticipation of claims 1, 7, 11, and 18 – 20 do not directly place claims 2 – 6, 8 – 10, and 12 – 17 in condition for allowance.

Conclusion

14. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event,

however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to David P. Rashid whose telephone number is (571) 270-1578. The examiner can normally be reached Monday - Friday 8:30 - 17:00 ET.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Brian Werner can be reached on (571) 272-7401. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

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